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To whom it may concern:

I have been asked to provide an independent expert review of the delisting plan for the Island Night Lizard (*Xantusia riversiana*), a species endemic to three of the Channel Islands off the coast of Southern California. In addition to my 15 years as a practicing herpetologist and extensive research on population genetics, dispersal, and social behavior in the mainland sister species, the Desert Night Lizard (*Xantusia vigilis*), my qualifications for this review also include recent visits to or work on all three islands inhabited by Island Night Lizards (San Clemente Is.: 2005, 2006, 2007; Santa Barbara Is.: 2007; San Nicolas Is.: 2006) and qualitative observation of both habitat characteristics and relative lizard activity and abundance on each island. I mention this not in an attempt to add information to the rigorously-collected quantitative data presented in this report, but rather to give background and context to the interpretations and perspective that follow.

### **Overview of my review**

**General assessment:** My assessment of the proposed rule and its extensive related material is that the criteria for delisting generally have been met (but see “Concerns with the plan and rule” below) for San Clemente Is., marginally met for Santa Barbara Is., and not adequately met for San Nicolas Is. My review suggests that these three island populations should be managed individually as distinct population segments (DPS), and delisting should not be applied to the San Nicolas Is. population at this point in time.

**Merits of the plan and rule:** The USFWS, US Navy, and National Park Service have impressively coordinated in a very commendable effort to identify risks to Island Night Lizards and work to amend them, especially with nonnative animal removal. Although a number of risk factors were identified on the original listing and subsequent reports, I think the two biggest threats have been 1) habitat loss and erosion caused by historical grazing, and 2) predation by feral cats. It is inspiring to see such successful feral animal removal and such careful thought being given to preventing further soil erosion and to habitat restoration. The Island Night Lizard Management Areas (INLMA) on San Nicolas Is. and San Clemente Is. are a key factor in the persistence and any future recovery of these lizards, and I applaud their creation. I am especially impressed with the thoroughness of the post-delisting monitoring plans on each island.

**Concerns with the plan and rule:** Although I have further comments on findings of this report given the data that are available, a main concern is first that two key pieces of information are missing from the report that are necessary for a best practices assessment of 1) the “significance” and potential (or lack thereof) for “redundancy” of each population in relation to the species as currently described, and 2) the “resiliency” of the populations given current and historical management efforts. In the first case, the report has surprisingly provided no modern molecular estimate of genetic differentiation among the three islands or estimates of genetic population structure within islands to adequately identify and characterize the nature of the biological resource itself. However, the little genetic evidence presented from the

allozyme/karyotyping study (Bezy 1980) suggests that these three populations (two of them already named as separate subspecies) are each quite distinctive and have been separated without gene flow for at least 500,000 years, with the greatest standing variation in both allelic diversity and color pattern (a phenotypic marker) of the three populations being found in the San Nicolas population. Current readily-available, low-cost molecular tools would provide a simple method to determine if these populations are interbreeding units that qualify as a single “species” (pg. 7934) or independent entities with substantial unique variation that is not redundant and which should be considered distinct population segments. In the second case, best practices suggest that estimates of population stability should come from a comparison of at least one historical population census on each island with at least one recent population census, but only a single complete census of lizard population size for each population has been provided here (although some auxiliary data such as trap capture rates and adult to juvenile ratios exist from San Clemente, and these can fill this role to some degree for that population). Censuses of *habitat* as a proxy for lizard population health are inadequate until at least one additional direct demographic survey is completed within each island for comparison to the historical baselines to determine if the use of such a proxy is truly valid. Additionally, the lack of recent direct census prior to issuing this proposed rule change lends skepticism about how well the ambitious post-delisting monitoring will be carried out. In my opinion, the addition of genetic information and recent population censuses would provide a much better foundation for assessing the relative merits of delisting within each population. Although the very large population size of San Clemente Is. and the relatively low impact habitat of Santa Barbara Is. mitigate the concern caused by the absence of these data, the small, heavily-impacted San Nicolas Is. population cannot be adequately assessed without this information.

### **The report’s comparison among islands**

Before addressing my review of the information behind report’s recommendation, I want to flag a very important mistake in the presentation of data in Table 1 that leads to a misleading comparison of the size of populations on each of the three islands. The header on the column furthest to the right in this table specifies that the population sizes are given in millions [“Estimated population (million)”, pg. 7914]. However, the numbers for San Nicolas and Santa Barbara are actually given in thousands, which can mislead readers in one of two ways. First, a reader could interpret that the heading is correct and that all of the numbers are in fact given in millions, such that there are 15.3 *billion* (15,300 millions) and 17.6 *billion* lizards on the two smaller islands, respectively. Alternatively, a reader might catch the numerical mistake based on the description in the text and recognize that the latter two numbers are actually given in different numerical units than the first, but fail to recognize just how much smaller the populations are on San Nicolas and Santa Barbara in comparison to San Clemente because they are not in equivalent units. The table should be presented as one of the following two options in order to become mathematically accurate:

#### **Corrected option #1:**

TABLE 1—ISLAND SIZE, AMOUNT OF HABITAT, AND POPULATION SIZE OF THE ISLAND NIGHT LIZARD

Island	Size	Amount of high-quality habitat*	<b>Estimated population (millions)</b>
San Clemente .....	37,200 ac (15,054 ha) .....	19,640 ac (7,948 ha) .....	<b>21.3</b>
San Nicolas** .....	14,230 ac (5,698 ha) .....	11.8 ac (4.8 ha) .....	<b>0.0153</b>
Santa Barbara .....	640 ac (259 ha) .....	25.9 ac (10.5 ha) .....	<b>0.0176</b>

\* High-quality habitat (*Lycium californicum* and *Opuntia spp.*).

\*\* Amount of habitat includes cobble and driftwood habitat unique to San Nicolas Island.

Corrected option #2:

TABLE 1—ISLAND SIZE, AMOUNT OF HABITAT, AND POPULATION SIZE OF THE ISLAND NIGHT LIZARD

Island	Size	Amount of high-quality habitat*	Estimated population
San Clemente .....	37,200 ac (15,054 ha) .....	19,640 ac (7,948 ha) .....	<b>21,300,000</b>
San Nicolas** .....	14,230 ac (5,698 ha) .....	11.8 ac (4.8 ha) .....	<b>15,300</b>
Santa Barbara .....	640 ac (259 ha) .....	25.9 ac (10.5 ha) .....	<b>17,599</b>

\* High-quality habitat (*Lycium californicum* and *Opuntia spp.*).

\*\* Amount of habitat includes cobble and driftwood habitat unique to San Nicolas Island.

Using the numbers from the table above for further calculation, I would have added at least three more columns to this table to better compare the status of lizards and their habitat among the three islands within standardized units: 1) density correcting for overall island size (lizards per total acre/hectare), 2) density within high-quality habitat (lizards per habitat acre/hectare), and 3) percentage of good habitat given overall island size (unit quality habitat per unit total area). I mention these points here, and flag them as important, because these calculations show San Nicolas to be an extreme outlier from the others, and this comparison would be helpful to readers by presenting easily comparable metrics for each island. I have included this information in a new table below to better understand the rest of my review.

ADDITIONAL TABLE —COMPARABLE LIZARD AND HABITAT DENSITIES SCALED BY ISLAND SIZE

Island	Overall lizard density (# per ha)	Lizard density in high-quality habitat (# per ha)	Percentage of island with high-quality habitat
San Clemente	1414.9	2679.9	52.8%
San Nicolas	2.7	3187.5	0.08%
Santa Barbara	67.9	1676.1	4.1%

**Application of “species” definition**

From pg. 7934: *The Act defines “species” as follows: “The term ‘species’ includes any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature.”*

From this definition, we see that a unit is designated as a species when the adult population interbreeds. In the case of Island Night Lizards distributed across three islands each separated by miles of open water, no reasonable biologist would assume the existence of any current interbreeding among islands. Although very rare dispersal events may have existed historically (due to storms, mats of floating vegetation, etc.), the absence of Island Night Lizards from any of the other Channel Islands - including those much closer to the mainland (e.g., Catalina Is.) - strongly suggests that such events are not commonplace. There are few examples of “distinct population segments” that are clearer than the case of Island Night Lizards. I also note that nearly every section in this proposed rule is subdivided to address the status and concerns of each island individually, and this organizational scheme strongly suggests that even the writers of this report view these populations as separate entities facing relatively different challenges that must be described separately from each other.

Although these three populations have been considered separate entities through many iterations of USFWS reports, the change to dealing with all three populations as a single entity appears to have originated with the 2012 USFWS 5-year review. In this report, the justification for the change is as follows:

*Pg. 5: In this 5-year review we will forgo a DPS analysis of each island because the island night lizard is currently listed at the species level and we recommend reclassifying the listed entity throughout its entire range due to the amelioration of substantial threats and current management of potential threats to the species and its habitat. There is no relevant new information regarding the application of the DPS policy to the island night lizard, and the DPS policy is not addressed further in this review.*

First, the statement that the lizard is currently “listed at the species level” is a bit unclear, but I assume it refers to “listing” as the listing in the federal register, rather than the scientific taxonomic “listing” which clearly recognizes multiple subspecies (*Xantusia riversiana riversiana* on San Nicolas and *Xantusia riversiana reticulata* on San Clemente; Standard Common and Current Scientific Names of North American Amphibians, Turtles, Reptiles, & Crocodilians, Sixth Edition, 2009). It seems that because the original rule failed to accurately differentiate between the subspecies that were already taxonomically recognized by the scientific community (*X. r. reticulata* described in Smith, 1946; *X. r. riversiana* described in Cope, 1883), the scientific literature was subsequently ignored in the assessment of whether Island Night Lizards should be considered under DPS policy. This decision seems in clear violation of the above definition of a “species,” which at the very least requires that San Nicolas and San Clemente be considered separate entities. This omission is a severe weakness of the report, and I strongly recommend that this matter be resolved through some simple DNA sequencing or even microsatellite analysis to generate the necessary quantitative data to assess the “distinctness” of these populations because no such data have been used in this assessment thus far. I again submit that the old allozyme study by Bezy 1980, which is the best data currently available, strongly supports the position that these islands are separate units, as well as that San Nicolas harbors the greatest amount of distinct genetic diversity and should be of highest management priority.

I hereby consider each island as a distinct population segment for the remainder of my review.

### **Review of information regarding delisting by island**

USFWS objectives (paraphrased):

- Objective 1: Risk identification and amelioration
- Objective 2: Protect from further degradation
- Objective 3: Habitat restoration
- Objective 4: Identify high-quality areas
- Objective 5: Upgrade/Delist
- Objective 6: Continue monitoring recovery

Given the stated objectives above and the current task of determining the appropriateness of completing Objective 5, I assessed whether each island population has adequately met the requirements for Objectives 1-4.

**San Clemente:** The San Clemente population is clearly the most healthy of the three populations. Over half the island has high-quality habitat inhabited by a very large number of lizards, and the continuous monitoring of body condition and juvenile:adult ratios by Bill Mautz combined with the sincere investment by the US Navy into native plant restoration, invasive species eradication, erosion control, and the creation of Island Night Lizard Management Areas (INLMA) on San Clemente leave little doubt that the population is quite large and comparatively well-managed. Although feral cats are still present on this island, there has been a long-running predator management team in place for some time. Because cat

population control is run at least in part for the loggerhead shrikes and island foxes as well, and I expect that this program will continue for the foreseeable future (hopefully with complete eradication from the island at some point). Future land use plans seem balanced, and given how large this population is, future activities concentrated outside of the INLMA are reasonable. It is great to see plans for future erosion control as any further development may occur. Overall, the Navy has done an impressive and commendable job balancing their activities with Island Night Lizard priorities on San Clemente, and I sincerely encourage them to continue their great track record even in the absence of formal listing.

From the information provided, I believe that Objectives 1-4 have been met, and **I find that delisting is reasonable for this island at this time**. However, I also recommend completing the genetic work and running another complete population census with comparable methods to the Mautz 2001 survey for direct comparison to baseline as soon as possible as part of post-delisting monitoring.

**San Nicolas:** This population is of the greatest conservation concern. Given the fairly large size of the island, the Island Night Lizard population is surprisingly small (15,300 lizards), less even than Santa Barbara Island even though it is over 20 times its size. A staggeringly large portion of the island is degraded due to severe erosion resulting from overgrazing, leaving less than 0.1% of the island with high-quality habitat for lizards. Until this habitat is properly restored, we cannot expect this population of Island Night Lizards to reach a more reasonable level. Thus, I conclude that although both risks and high-quality areas have been identified and some of those risks have been ameliorated, the greatest barrier to population recovery to expected levels is the failure in Objective 3, habitat restoration.

Page 7924 of the proposed rule states that “*Erosion on San Nicolas Island was exacerbated by historical land use practices and the introduction of nonnative herbivores (Service 2006, p. 12; Service 2012a, p. 29); residual effects continue to be a potential concern due to the limited amount of, and time required to reestablish, high-quality lizard habitat [emphasis mine]. Currently, moderate and high-quality island night lizard habitat occurs in areas considered by the Navy to have a moderate- to high- soil erodibility. However, steps are being taken by the Navy to reduce and manage current impacts from erosion on San Nicolas Island and such efforts are expected to continue in the future. Therefore, we do not consider erosion to currently be a substantial threat to the island night lizard or its habitat on San Nicolas Island now or in the future.*”

I disagree; pers comm with Ruane 2013 states that “the first funds are coming in” but he has “no specifics [on] the plant nursery yet” and “guess[es]” that “planting (for lizards) will occur in a year or a year/half.” This statement does not support the conclusion that any real progress has been or will soon be made in restoring the island to anything approaching its historic state. Pg. 7920 states that “The major threat to habitat (nonnative herbivores) was eliminated from San Nicolas Island, thus preventing further reduction of lizard habitat from this threat; and (2) the Navy is in the process of developing a habitat management and restoration program.” In fact, the issue is not current or future rates of habitat loss, the major threat is the current lack of suitable habitat due to erosion caused by the previous presence of nonnative herbivores (which were removed before listing). This threat has not yet been ameliorated in any meaningful way, and the proposed nursery, when it begins, is not intended to create much impact either as it “will not be a huge nursery operation, but [rather] will certainly help us create some additional habitat for lizards, specifically in areas where we are preparing to re-locate lizards that are captured when their habitat is being impacted and they are in harm's way.” Given the very small population size restricted to very tiny patches of habitat on an otherwise large island with quite a large space available for restoration, I conclude that Objective 3 has not yet been met despite great opportunity to do so. Given the slow recovery time of this habitat and dangerously low amount currently present, this population remains in a very precarious position with no sign of substantial population or habitat growth from the dangerously low levels currently present.

The fact that there is a high density of lizards in the cobble/driftwood area does little to sway my concern, as this patch of habitat is 0.2 ha in area (approximately 44m x 44m, equivalent to the size of about half a football field) and by calculation from reported densities (4000 per 1 ha) therefore contains approximately 800 lizards, which is a very small subpopulation indeed. When these numbers are directly compared to

those of San Clemente (which experienced erosion and habitat loss as well, although not on quite the same scale), we should expect an equivalent island the size of SNI to have a population size of approximately 8 million lizards rather than 15,000. Using that comparison, we can see just how short San Nicolas falls from the expectation even for islands highly impacted by historical grazing.

Small-scale, temporary habitat reconstruction through piling *Opuntia* and boards until cuttings are established (pg 7922) is an creative and likely helpful option (although, as also noted on pg. 7922, no rigorous monitoring for efficacy has been conducted) for small areas of impact and should be continued where warranted. In light of the avian perching discouragement plans, the San Nicolas wind turbine project is only somewhat worrisome to me due to the direct impacts on habitat loss (although it is not located in a high-quality area), but the plan seems reasonable overall. I hope relocation efforts for the affected lizards are successful, and I am pleased to see such measures being attempted. Also, the recent eradication of cats is fantastic news indeed.

From the information provided, I believe that Objectives 1, 2, and 4 have been met, but Objective 3 has not been met. Unfortunately, because of the probably genetic importance of this population (Bezy 1980) and the far more drastic habitat loss problems on San Nicolas, I think habitat restoration efforts will need to exceed those on the other two islands, and they have not yet even equaled them. Due to this issue, **I find that delisting is not reasonable for this island at this time.** As with San Clemente, I also recommend completing the genetic work and running another complete population census with comparable methods to the Fellers 1998 survey for direct comparison to baseline before delisting is revisited again.

**Santa Barbara/Sutil:** Although this island is by far the smallest of the three and thus most likely to experience population elimination due to any catastrophic stochastic event, the habitat on the island is decent and unlikely to experience further human-instigated degradation. The remoteness of the island (four hours by boat, often under conditions of big swell), restrictions on accessibility (no landing strip), and designation as part of the Channel Islands National Park all contribute to this population's protection from further loss. However, only a small portion of the island (~4%) is high-quality habitat, and there may be more opportunity for habitat restoration in the future. The NPS current and future plans for habitat restoration seem reasonable to continue addressing this issue. The removal of nonnative rabbits was a big step towards reducing risks to this population of lizards, and I commend the NPS for their excellent work. I find that Objectives 2, 3, and 4 have been met for this population.

The only remaining issue in terms of the decision to delist is about risks posed by the very small overall size of the island, which cannot easily be ameliorated and has not been adequately addressed in this report (Objective 1). Because populations restricted to very small areas have higher extinction probabilities, care must be taken in the decision to delist. **I find that with certain precautions in place, however, delisting may be suitable for this population.** One potential way to address this residual risk is to have 1) increased monitoring of the Santa Barbara population relative the other islands to more quickly detect a population collapse should one occur, and 2) have a contingency plan for a captive breeding program in place specifically for this population that could be initiated if necessary. With these (or potentially other) extra protections in place, this population could reasonably be delisted provided that habitat restoration continues. As with the other two islands, I also recommend completing the genetic work proposed for previous sections and running another complete population census with comparable methods to the Fellers and Drost 1991 survey for direct comparison to baseline as soon as possible.

### **Recommendations in the absence of DPS recognition**

**If there is no option to delist only the two healthy islands with the third remaining listed, then my recommendation is against delisting entirely.** The proposal could be revisited when the genetic and current census work are completed, but I do not envision a scenario in which a professional scientist could ever consider these populations to be biologically redundant or interbreeding, and the fragile state of the San Nicolas population will always hold back the delisting of the others. Additionally, refusing to

consider each population separately seems lacks a nuanced appreciation for the needs of the management situation, and I think that this approach is not ideal. I strongly recommend a management strategy tailored to each population as a distinct population segment, not unlike the version that has already been written that caters to the needs of each island individually, with the modifications that I have proposed here.

Thank you very much for giving me the opportunity to comment on this proposed delisting plan. Please do not hesitate to contact me if you would like any further clarification about this review.

Sincerely,



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